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PROGRAM WIND

A FORESTRY PERSPECTIVE

USDA - Forest Service
Forest Pest Management
2121C Second Street, Ste. 102
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EXECUTIVE SUMMARY

The USDA Forest Service (FS) is cooperating with the U.S. Army and others in the conduct of an atmospheric study referred to as Program WIND (Winds in Non-Uniform Domains) in northern California. The field data gathering portions of Phase I (Summer), Phase II (Winter) and Phase III (Spring) have been completed. Analysis of data from Phases I, II, and III is in progress. The purpose of the Study is to collect data to evaluate, enhance, and develop meteorological and particulate dispersion models. In regard to forestry, models are important tools for predicting events for environmental and operational purposes before conducting field operations such as controlled burns and pesticide applications. The FS's prime interest in models is in their utility toward improving smoke management, and the safety and efficacy of aerial application of pesticides used in forestry. Results of Program WIND will be published in trade and scientific journals, and will be presented at society meetings. For further information call Jack Barry, Program Manager, (916)758-4600 or write to USDA Forest Service, Forest Pest Management, 2121C, Second Street, Davis, CA 95616.

PROGRAM WIND

INTRODUCTION

The USDA Forest Service (FS), the U.S. Army Atmospheric Sciences Laboratory (ASL), White Sands Missile Range, and U.S. Army Dugway Proving Ground (DPG) are conducting a major atmospheric study referred to as Program WIND in northern California. The Program is managed by a FS Program Manager and a U.S. Army Deputy Program Manager. The Program Manager receives policy and Program approvals from a policy committee (Appendix).

The Program is being conducted in a mountain-valley setting between Chico, CA and Red Bluff, CA. The 2500 square mile area is bounded on the west by Interstate 5, on the east by State Route 32, and on the north by State Route 36. This is the first study of this scale attempted worldwide, in terms of the type, quantity, and quality of meteorological data collection. Interagency cooperation and advancements in instrumentation have made this study possible.

The purpose of the study is to characterize atmospheric conditions in non-uniform terrain by obtaining meteorological data during each of the four seasons and during different times of the day. Data will be used to evaluate, enhance, and develop predictive mathematical models. Models have suffered for need of a data base sophisticated enough to quantify the physical processes at play in the atmosphere. These include models which predict (1) wind flow over a mountain-valley complex, (2) influence of forest and crop canopies on wind flow, (3) dispersion of smoke, air pollution, dusts, pesticides, and other agricultural materials and (4) effects of aircraft wake on dispersion of aerial sprays and dry materials. Theory can now be tested and compared to reliable data input obtained from the atmosphere.

Specifically the FS is interested in models which predict dispersion of smoke from controlled burns and movement of air pollutants and pesticide drift, and penetration and deposition of sprays into and on forest/range canopies. Data collected during Program WIND also will be used by the FS to develop and to make FS spray models simpler and easier to use in the field.

The U.S. Army is primarily interested in a capability to predict atmospheric conditions as they affect obscuration from smoke and dust over a 2500 square mile area. Foresters have similar interests.

Weather data (wind speed, wind direction, temperature, solar and UV radiation) are being collected at 50 stations throughout the study area. Located at the other stations are towers which reach above the forest canopy, radiosondes, accoustical sounders, tethersondes, and sonic anemometers. Data acquisition is designed for efficient analyses and data access.

SCOPE

Program WIND consists of four phases. The primary meteorological study was conducted during each phase. In addition several sub-studies were conducted during Phases I and III. These sub-studies are as follows:

Phase I (Summer), Completed

Aircraft wake sub-study in coniferous forest and clearing using Jet Ranger helicopter and Cessna Ag Truck aircraft.

Aircraft wake sub-study over deciduous trees (almond orchard) using Hiller 12E helicopter and Ag Cat aircraft.

Canopy penetration, spray drift and safety sub-studies in a deciduous forest using Hiller 12E and Ag Cat.

Phase III (Spring), Completed

Canopy penetration, spray drift, and safety sub-studies in a coniferous forest.

Aircraft wake, spray deposit and drift sub-studies using a helicopter in a site preparation or conifer release setting.

Event model for complex terrain (EMCOT) sub-study in a site preparation or conifer release setting to determine "spray window." A simple method is needed to determine when to stop spraying in order to avoid excessive drift and to insure maximum spray deposition on target.

Canopy edge sub-study to obtain data for a model which predicts timber blowdown in coniferous forest.

Canopy edge sub-study to measure effects of canopy edge on fire and smoke dispersion.

Phase IV (Fall 1987), In Planning

Smoke management and dispersion sub-studies along forest edge and in open complex terrain.

Dispersion tracer sub-study in a coniferous seed orchard and site preparation setting using a helicopter and a fixed wing aircraft.

COOPERATORS

Cooperators include State of California, University of Washington, University of California, New Mexico State University, National Oceanic and Atmospheric Administration, California State University in Chico, University of Connecticut, U.S. Air Force, and others.

Results of the first three phases are being analyzed. Results will be published, by each agency and cooperator, in trade and scientific journals and presented at society meetings. Requests for information should be made to the Program Manager, USDA Forest Service, Forest Pest Management, 2121C, Second Street, Davis, CA 95616 (916)758-4600.

FORESTRY APPLICATIONS

Several of the sub-studies and their application to forestry operations are as follows:

1. Smoke and Canopy Edge Studies. The FS and U.S. Army have models which predict smoke and wind behavior in clearcuts and along forest edges.

APPLICATION. These models can be used to plan and to analyze project work sites for smoke management, potential fire spread and timber blowdown.

2. EMCOT Model. The Event Model for Complex Terrain (EMCOT) was evaluated during Phase III. Once validated we will have a simple, quantitative, and practical method for determining when to stop spraying. It is desirable to stop spraying when spray is being lost due to evaporation, vertical uplifting, drifting downwind or otherwise not depositing on target.

APPLICATION. This method, in easy-to-use format, would be helpful to persons planning and conducting pesticide spray projects. Off-target drift and ineffective control are major deterents to pesticide application. Many problems result from spraying under unfavorable conditions.

3. FSCBG Model. This model predicts penetration of spray into forest canopies, spray deposition, and downwind drift. It's a sophisticated model which also can be used to account for all spray at any point in time after spray release. Meteorological and spray deposit data collected during this program will be used to evaluate model predictions. A U.S. Air Force (USAF) C-130 aircraft was used in this sub-study to study canopy penetration, spray deposition and drift. Also a commercial Bell 206 helicopter was used to apply spray. The USAF group supporting this sub-study has been spraying gypsy moth, spruce budworm and grasshoppers on DOD lands. This model is ideally suited to generate data needed to analyze environmental hazards and to prepare risk assessments related to pesticide use.

APPLICATION. This model can be used for planning aerial spray operations. The model can be used to generate information for environmental and risk analyses, and to plan safer and more efficient and economic aerial applications.

4. AGDISP Model. This model predicts spray aircraft swath or deposits as a function of spray height, nozzle type, nozzle placement, aircraft type (weight and size), aircraft speed, drop size, application rate, weather conditions and forest type. Aircraft (fixed and rotary wing) are being tested in coniferous, deciduous, and site preparation settings to evaluate the model and to obtain operational data.

APPLICATION. The AGDISP model can be used for planning aerial spray applications including environmental inpact and risk assessment, specifications for spray aircraft, estimating spray drift, calculating width of buffer zones, determining proper flight profiles and estimating spray aircraft costs.

5. Meteorological Study. Several meteorological models are being evaluated by the FS and U.S. Army. These predict winds and other atmospheric conditions over large land areas. Program WIND data will be available to scientists studying forecasting and dispersal of airborne materials such as smoke, air pollutants and pesticides.

APPLICATION. FS Research has several meteorological models which can be used to predict movement of airborne materials over large (80x80 km) land areas and complex terrain. U.S. Army models can be applied to forestry problems.

SUMMARY

The field portions of the first three phases of Program WIND successfully met the scientific objectives and administrative objectives. Data collection exceeded 90% of target and there were no accidents nor adverse public incidents. Program WIND was possible due to interagency cooperation and sharing of resources.

Theoretical models which predict events in the atmosphere and in forest and crop canopies had advanced to the point that field measurements were needed. This coincided with advances in instrumentation technology, making available methods to obtain the quality and quantity of data necessary to evaluate models.

Through this classic study and the support of management of the USDA Forest Service and the U.S. Army Atmospheric Sciences Laboratory and cooperators, data will be available to practicing foresters and the scientific community. These data will make it possible to predict consequences of manmade events in and adjacent to the forest environment and its atmosphere.

Plans are in progress for Phase IV during September-October 1987.

Appendix

PROGRAM WIND POLICY COMMITTEE

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